The Northwestern MILLER
MILLING PRODUCTION SECTION

# Use of the X-Ray in Milling Wheat Selection

***By Don Dubois***

**Chief Chemist, Crete (Neb.) Mills**

INSPETION of wheat and related cereals for internal insect infestation by means of the x-ray was introduced by Dr. Robert Katz and Dr. Max Milner at Kansas State College approximately two years ago. Since the time of the release of their preliminary studies, this technique has developed to the stage where it has been accepted favorably by many milling organizations as another tool for detection and control of internal or hidden infestation in our grains.

The x-ray procedure involves the even distribution of wheat or other grain one layer thick on a transparent tray, 14x17 inches. The tray is placed in the machine, the film in a holder or cassette being placed immediately above the layer of grain. The film is then exposed to the x-rays for a period ranging from 30 seconds to 2½ minutes, depending upon the grain being filmed, the contrast desired in the final plate, and the setting of the other variables of the machine, namely, the kilovoltage and the milliamperage. After exposure the film is taken to the dark room for developing.

The total elapsed time for printing and developing of a plate, including the drying of the film, is approximately 2 hours. This time interval could be reduced by at least one hour by artificial drying of the plate by one of the means employed by commercial photographers.

It has been the experience of this laboratory that a heavily infested sample can be detected by rapid visual inspection immediately following the developing process, or within approximately 20 minutes after the sample has been received. This inspection of the wet film is accomplished by use of a vertical film viewer and can be viewed in two to three minutes. However, experience has shown that, except in cases of gross infestation, this rapid viewing must be followed by a careful and thorough examination of the dry film with a viewer similar to type described later.

### Light or Medium Infestation

In cases of light or medium infestation, the rapid investigation is sometimes questionable, since the operator may notice several infested kernels at this time, and later upon close examination find that he has a plate with a low total number of kernels with internal infestation. On the other hand, he may fail to detect some contamination which becomes evident upon close examination. It appears that a satisfactory control procedure to follow would be a preliminary viewing of the plate for gross infestation followed by a thorough inspection of the dry film for the final report.

The change from one plate to the next requires approximately five minuntes (including the exposure of the film), so one operator can handle one operation in eight minutes. This additional three minutes is allowed for the changing of plates already exposed from the developer to the fixer, and from the fixer to the wash. With this time interval, one operator could expose and develop approximately eight plates per hour, not including the viewing of the dry plate. Two operators could nearly double this output. Since the x-ray machine must be turned off for the same length of time as the film is exposed, the maximum output with a two minute exposure would be 15 plates per hour.

Various size samples have been used, the range being from 25 to 200 grams. Numerous tests have indicated that consistent results could be obtained with a 100 gram sample of wheat. This sample covers one-half a standard 14 by 17 inch film, so ordinarily two samples are exposed simultaneously. In this manner, the normal output of the machine would be from 16 to 30 samples an hour, depending upon the number of personnel utilized in the operation.

A table viewer has been constructed which has been very satisfactory for the study of the finished plate. This viewing table has a slanting top similar in size and angle to the engineers' drawing board. The table top has a slit 1 inch by 17 inches in the center of the top in which has been placed a frosted glass.

Beneath the glass and enclosed in a metal reflector are three 20-watt fluorescent bulbs wired so that three light intensities may be obtained through the frosted glass. The plate is viewed by placing it on the table and inspecting the area lighted by the glass. The field is narrowed in this manner, and internally infested kernels may be readily detected. Utilizing this type viewer, a 100 gram sample may be studied thoroughly in 10 minutes or less.

A study of the relative number of internally infested kernels as shown by the x-ray and the number of insects found by the cracking-flotation method on the same sample has been conducted. 100-gram samples of 98 lots of wheat were x-rayed and examined. Then these 100-gram samples were removed from the machine and checked by the cracking-flotation method involving a coarse cracking of the grain with a laboratory grinder, followed by digestion in boiling water. The floating material is decanted off and a sanitation analysis using the acid digestion method was made.

The results are shown in the following table:

| Infested kernels per 100 grams by X-ray | No. samples checked | Average No. infested kernels by X-ray | Average No. insects by cracking |
|---|---|---|---|
| 0-5 | 46 | 3.4 | 2.0 |
| 6-10 | 32 | 6.4 | 3.5 |
| 11-15 | 14 | 12.6 | 7.3 |
| 16-20 | 4 | 18.5 | 15.0 |
| 21-25 | 2 | 22.0 | 16.0 |

Note: An infested kernel in the X-ray was regarded as a kernel containing any signs of internal infestation.

These studies were conducted on uncleaned wheat, the majority being composites of car samples. This study was purposely made on wheat before cleaning because it was felt that, to be of the greatest value in controlling hidden infestation in incoming grain, the test should be completed before the grain enters the mill. Second, although an efficient cleaning system removes much of the infestation before the wheat is milled, any infested wheat separated in the cleaning process constitutes a substantial loss to the processor.

This study has indicated that there is some relation between the amount of infestation as shown by the x-ray and by the cracking flotation method used by numerous control laboratories.

A sample of wheat containing active but hidden infestation may contain every life stage of the insect within the kernel and these stages may be identified upon close inspection of the x-ray.

An infested sample which has been fumigated several months prior to filming presents a different picture, however. In this case the advanced life stages tend to dessicate and are nearly indistinguishable from one another. In a program emphasizing the control of hidden infestation in grain arriving at the mill, this factor loses some of its importance.

The matter of paramount importance is that the wheat does contain internal infestation, and this fact can easily be detected by x-ray. This point is important in that the miller can usually determine if the hidden insects may be active or if the insect life has been destroyed by fumigation at an earlier date.

The fundamental purpose of the installation of the x-ray machine in the products control laboratory is to control the hidden infestation in the grain received and to maintain a vigilant watch over the grain stored within the elevator facilities of the mill.

A practical method for such a control program would be to x-ray car samples and noting locations having consistently low infestation counts. This laboratory has found this control measure very effective and has eliminated a few locations from its buying program because of continued high hidden infestation counts from these areas. It is believed that any control laboratory possessing x-ray equipment could establish some type of program in cooperation with the purchasing department which would aid in selection of grain relatively free of infestation.

A second use, equally as important as the control of incoming grain, is the control of the infestation in stored grain within the mills. By periodical checking of the stored grain, any appearance of internal infestation can be detected and handled with the necessary precautions.

### Many Possibilities of Use

What are the possibilities of the x-ray machine? Apparently, the detection of hidden infestation is only one of the possible uses of the machine. Some work has been done at Kansas State College on extremely weathered wheat which may be detected on the x-ray plate as weatherchecks or cracks within the kernel. A report on this was submitted to the national meeting of the American Association of Cereal Chemists in April of this year.

Some oat millers have been interested in the machine and suggested its use in determining the size of the oat groat within the hull, an important factor in that industry. The maturity of the groat is shown very clearly by the x-ray.

What are the advantages offered by the use of the x-ray technique?

(1) The technique offers a positive, easily interpreted, permanent record of the hidden insect in-

(Continued on page 18a)

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# INFLUENCE OF ATMOSPHERIC HUMIDITY ON MILL OPERATIONS

***By R. E. W. Murray***

**Editor's Note—The accompanying article is a portion of a thesis which was awarded the gold medal by the Technical Education Committee of the National Joint Industrial Council for the Flour Milling Industry of Great Britain. It is reprinted from a recent issue of Milling.**

IT has often been alleged that increase in atmospheric humidity causes the silk threads of dressing covers to swell, thereby diminishing the aperture size and decreasing the rate of sieving. J. H. Scott, in "Flour Milling Processes," states that the most recent investigations on this subject have demonstrated that the alterations in silk mesh under humidity fluctuations of the order experienced in flour mills are almost negligible, and that the decrease in sieving efficiency associated with higher moisture, whether in the stock or in the atmosphere, is due not to reduced silk apertures, but to the increased tendency of the stock particles to form agglomerates and to adhere to the silks.

Pence (1933) reported that variations in size of openings in silk bolting cloth due to changes in humidity were so slight that little change in bolting capacity resulted.

Dr. Pulkki (1950), however, showed that although electrification was evident in some of the experiments, the humidity of the atmosphere and the moisture of the flour have a great bearing on the size of the apertures of the silk cloth. In his experiments, the apertures and the threads of the silk bolting cloth were measured with a microscope furnished with an ocular micrometer. The measurements were performed first in a dry room's atmosphere and then again after a piece of the cloth was kept for some time in a special moistening chamber.

The relative humidity of the room's air during the measurements was 34-45%, and the temperature 78° F. Increase in the relative humidity of air due to water could not be measured in the closed moistening chamber, but it can be estimated to rise at least to about 90%. Measurements were performed with flour sieve No. 12XX and with grit gauze No. 18. The data of the former is shown in Table 1.

From the table, it appears that the silk thread has a tendency to swell in humid air. An increase in the diameter of the thread is followed by a decrease in the aperture size of the silk. Accordingly, the through-put ought to be greater the lower the relative humidity of the air, and this is found to be true in examining Table 2 and comparing Tests 4 and 5 in the section dealing with Electrification, but the difference in flour moistures should be borne in mind. By means of microscopic examination, it is easy to detect that flour particles swell considerably in humid air.

Although, as already stated, the through-put ought to be greater the lower the relative humidity of the air, at the comparatively low relative humidity of 35% and with flour moistures below 10%, electrification opposes sieving and the effect of fluctuating aperture size is nullified.

It is interesting to note that only very slight variations, within —1.05 to + 0.5%, were caused in the total length of the silk bolting cloth by the effect of moisture in this experiment.

The difference in relative humidity levels during the test (35—45 to 90%) to procure the variations in thread and aperture size as shown in Table 1 is extreme, and in actual practice inside the mill such a large difference would occur only on very rare occasions. Normal humidity fluctuations, therefore, would cause considerably less variation to thread and aperture size and the resultant effect on sieving will be small indeed, probably smaller than the differences arising out of using new and worn covers, or covers of varying tension.

### The Practical Viewpoint

Most millers agree that a change in atmospheric conditions can affect the milling process, but few are prepared to enlarge on this subject and say to what degree the process is affected.

A commonly held view is that on a warm, muggy, or sultry day, when the relative humidity is high, it is difficult to maintain the extraction level without making some compensating adjustment in the mill. Seldom is consideration given to, or thought expressed of, other factors which may also be affected, such as moisture, ash, and maltose content. The most apparent factor is the fall in the extraction figure.

As the relative humidity increases, so the evaporative capacity of the air in the mill is reduced. This is probably the most important effect of atmospheric humidity changes on milling operations. As this air is drawn through machines and comes into immediate contact with the stocks, moisture losses which normally take place are reduced and the feeds become in fact damper. A falling off in dressing capacity with increased stock moisture results, due directly to greater cohesivity and adhesivity of the particles which also cling more readily to the silk meshes. Particle size increases slightly, therefore contributing to a smaller percentage of throughs. A possible slight reduction in the aperture size of the mesh due to swelling of the threads will also reflect in poorer dressing. If an increase in humidity is, in addition, accompanied by increase in temperature, dressing will be further impeded.

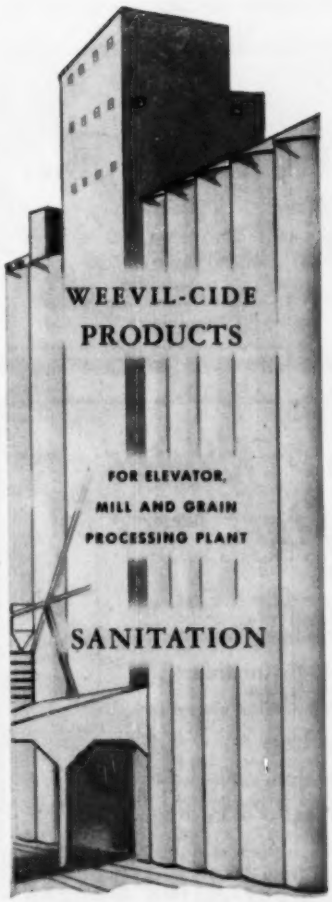
The difficulty then arises in endeavoring to show exactly the extent that variations in atmospheric conditions are responsible for resultant variations in milling results. If it were possible to mill a perpetual grist of identical quality which could be conditioned to an exactly similar degree of moisture and hardness, then it would be relatively simple to assess the true effect of humidity variations if, in addition, no adjustments were made in the mill.

If a fall in extraction is coincidental with an abrupt rise of humidity, it is more usual to accept this change in atmospheric conditions to be the true reason without examining the possibilities of slight moisture increase in the wheat, a change in conditioning, or variation in wheat quality as being the actual or contributory cause.

The accompanying graphs compare figures, taken in a mill manufacturing Springs and Winters flour over a period of approximately 10 weeks, for flour extraction and relative humidity determined every 12 hours. No consideration has been given to shut-down periods or changes from one grist to another. One set of figures was taken during December, January and February and the other graph represents readings taken in May, June and July. It will be observed that there is a decided tendency for the extraction figure to fall when the relative humidity rises appreciably, and vice versa. Equally significant is that during the summer months when humidity fluctuations were greater, extraction figures were also more erratic, whereas during the winter period the relatively stable humidity conditions were reflected by less variation in the extraction rate. On comparing the two graphs, it would certainly appear that humidity variations had a greater effect on the extraction figure than any other possible variations such as wheat moisture and quality. These latter variations were pre-

**Table 1—Effect of Atmospheric Humidity on Aperture Size of Silk Bolting Cloth**
Microscopic Measurements of Thread and Aperture Widths in Dry Air (0) and After 4 and 21 Hours' Duration in Moistening Chamber

| Thread, twisted 1/1,000 of 1 m.m. | | | Aperture 1/1,000 of 1 m.m. | | | Thread, plain 1/1,000 of 1 m.m. | | |
|---|---|---|---|---|---|---|---|---|
| 0 | 4 hr. | 21 hr. | 0 | 4 hr. | 21 hr. | 0 | 4 hr. | 21 hr. |
| 121 | 128 | 123 | 62 | 55 | 52 | 150 | 160 | 165 |
| 95 | 105 | 111 | 104 | 93 | 89 | 145 | 156 | 158 |
| 119 | 126 | 126 | 98 | 88 | 80 | 134 | 147 | 152 |
| 91 | 100 | 104 | 116 | 103 | 100 | 130 | 141 | 144 |
| 93 | ... | 104 | 89 | 76 | 71 | 132 | 143 | 147 |
| 85 | 91 | 93 | 114 | 102 | 93 | 134 | 145 | 150 |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sumably similar and fairly constant during winter and summer.

**Effect of Controlled Humidity**—Many suggestions have been put forward from time to time regarding the optimum humidity and temperature at which a mill should operate. The figures most favored vary from 60 to 70% relative humidity at a temperature of 65 to 70° F., and a little support is given for values higher than this. On the other hand, preference has been expressed for a relative humidity as low as 40%.

Air temperature should be controlled at a figure which would assist towards cooler stocks, yet still be warm enough for comfort of personnel—about 60-65° F. Air temperature and humidity can be controlled together if complete air conditioning equipment is installed.

It would appear that it is much more desirable to maintain any relative humidity chosen, at a constant level, if regularity is the principal aim. If an optimum figure does exist, then it is reasonable to suggest that this will depend largely on the initial moisture content of the wheat to the I Break Rolls. If controlled humidity were practised in any given mill, a certain amount of experimental work would really be necessary first to assess the most suitable humidity figure for that mill, bearing in mind the moisture of the wheat, type of flour to be made and moisture content of finished products. High humidity would result in low milling loss and lower ash content of the finished flour. Under conditions of low humidity, milling would be easier in that stocks would be more lively, separations more easily made and extraction would present no difficulty, but milling loss would increase. If the percentage of humidity became too low, the quality of the flour as indicated by the ash content would de-


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teriorate markedly with evaporative losses very high.

It may be argued that although fluctuations in humidity cause irregularities in the milling process, such irregularities can be countered by mill adjustment in the same manner as adjustment is made for variations in the conditioning process, or for wheat quality. Whilst this is true, atmospheric changes cannot be foreseen with certainty and are often very sudden, and in consequence their effect has upset the mill for some time before compensating adjustment is carried out, causing irregularity in the finished products. One advantage, therefore, of having a system of controlled humidity would be to remove this variable in the milling process.

Under systems of pneumatic conveying, where stocks are brought into more intimate association with the air and, therefore, subjected to a greater degree to the influence of the air humidity, mill stocks become very much more sensitive to atmospheric changes. Low humidity produces a greater drying effect and consequent larger milling loss than in the elevator system of conveying. Controlled humidity would, therefore, be a greater advantage for the pneumatic mill.

As relative humidity is reduced, the capacity of the mill increases, but under pre-war milling conditions the principal financial gain resulting from controlled humidity would be in yield. Improved divides, controlled milling loss and increased feed to the mill are subsidiary advantages. If quality is regarded as a constant and if this is found to improve, it could be re-adjusted to the required level by adjustment to the extraction. Alternatively, the mill feed could be increased, power permitting, while retaining yield constant. Under controlled extraction rates the principal benefit would be in better quality of the flour or, alternatively, increased feed to the mill.

**Moisture Change in Stored Products**—The fact that flour and other mill products change in weight during storage has been well established. The rate of change depends chiefly on initial moisture, bulk of sample, relative humidity and air movement. As relative humidity is a measure of the evaporative capacity of the air, an equilibrium value could be established for the initial moisture of the flour at which figure the flour would neither absorb nor lose moisture to the atmosphere, irrespective of air movement or bulk of sample. Jute is also naturally hygroscopic and therefore if jute bags are maintained at the same controlled humidity at which the product is packed and stored, there should be no variation of weight from time of packing until time of delivery from the building.

After products have left the warehouse, they are then subject to atmospheric changes during transit and further storage, when variation in weight could take place, before use. It would, therefore, be of little value to practice controlled humidity conditions beyond the flour mill proper.

### Air Conditioning

General Considerations—Air conditioning may be defined as the production of the most desirable conditions of the atmosphere in a room or building by treatment of the air supplied for ventilation, this treatment including:

(a) Filtration.
(b) Warming or cooling.
(c) Air movement.
(d) Increasing or decreasing the moisture content or humidity.

Extremes of temperature, air

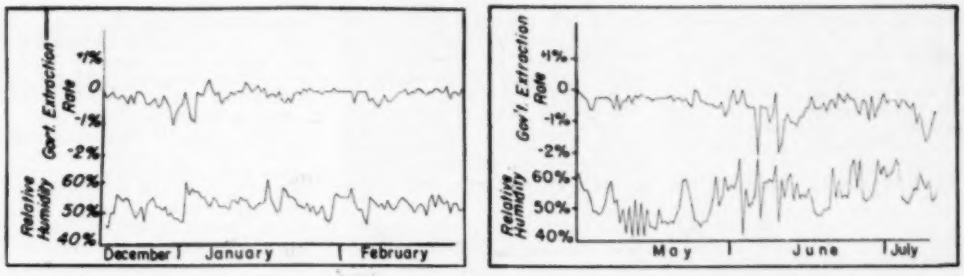


**Fig. 1—Graph showing rise and fall of flour extraction against fluctuations of relative humidity. Readings were taken each 12 hours.**

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movement, or contamination by smoke and dust are detected easily enough, but the part played by the moisture of the air is not so immediately evident to the senses. Its effect upon the milling process has already been discussed. Control of moisture of the air provides the chief distinction between ventilation and air conditioning.

The weight of moisture in the air, even in the saturated condition, is only a very small proportion of the total weight of the mixture—as will be seen from the following table, which also shows that saturated air is lighter than dry air.

| Volume | Dry-bulb temperatures | Weight—Air grains | Weight—Water vapour grains | Weight of mixture grains | Relative humidity |
|---|---|---|---|---|---|
| 1 cu. ft. dry | 70° F. | 525 | | 525 | 0 |
| 1 cu. ft. | 70° F. | 517 | 4 | 521 | 50% |
| 1 cu. ft. saturated | 70° F. | 511 | 8 | 519 | 100% |

In order to maintain effective control of the amount of this moisture in the air by producing constant conditions of relative humidity and temperature all the year round, a complete air condition plant is necessary. Such equipment for a large flour mill with a capacity of 80-100 sacks per hour might cost as much as $75,000, with additional running costs for operation and maintenance.

Because of this high initial expense for plant which is highly desirable, but not vital to production, the practice of partial air conditioning can be adopted instead. This reduces capital costs considerably—almost by half—but a constant temperature cannot be maintained during the entire year. Such a semi-air conditioning plant lacks means of cooling and refrigeration and, therefore it is during hot weather when full control of atmospheric conditions is not possible.

In order to reduce costs still further, a simplified form of air conditioning—in which there is little or no control of humidity, and sometimes with means of air heating only—is more often adopted in flour mills. This plant is installed principally for air filtration and forced ventilation.

### Air Pollution

In all systems and forms of air conditioning, invariably there is apparatus installed for dust extraction. Properties to be considered in the control of any dust are its composition, atmospheric concentration and particle size. Adequate control of dust may have as its primary objective the removal of health hazards, improvement of product quality, reduction of maintenance, removal of dust nuisance, or in some cases, the recovery of valuable materials.

The importance of removing dust from the air in a flour mill need not be emphasized. In order to exhaust each roller mill, as much as 160 cubic feet of air per minute may be required. For each 18 in. purifier, 1,500 cu. ft., and for each centrifugal, 100 cu. ft. which, for a 25-sack mill, gives a total of about 22,000 cu. ft. of air per minute, or almost 32,000,000 cu. ft. per day.

According to one authority, dust concentration in ordinary urban conditions is approximately 500,000 particles per cubic foot of air, whilst in heavy industrialized areas the number may exceed five million particles per cubic foot. Expressed in weight, this latter figure may amount to 1 grain per thousand cubic feet, which, for the air exhausted in a 25-sack mill, represents 4½ lb. per day, or just under one-eighth ounce per sack.

Chief among the dust nuisances is that of chimney smoke or soot, together with the fly-ash that accompanies it. The atmosphere also contains bacteria and spores, and for hygienic reasons it is essential to eliminate these from flour. The floating dust in the atmosphere can be grouped in a general fashion as follows:

| | |
|---|---|
| Smoke, carbons and soot | 45 to 47 % |
| Siliceous matter | 40 to 43 % |
| Coal dust | 2.5 to 3.5% |
| Fibrous matter | 3.0 to 4.5% |
| Miscellaneous | 6.0 to 8.0% |

Filtration, one of the fundamentals of air conditioning, provides the most efficient solution for the removal of airborne dusts and solids.

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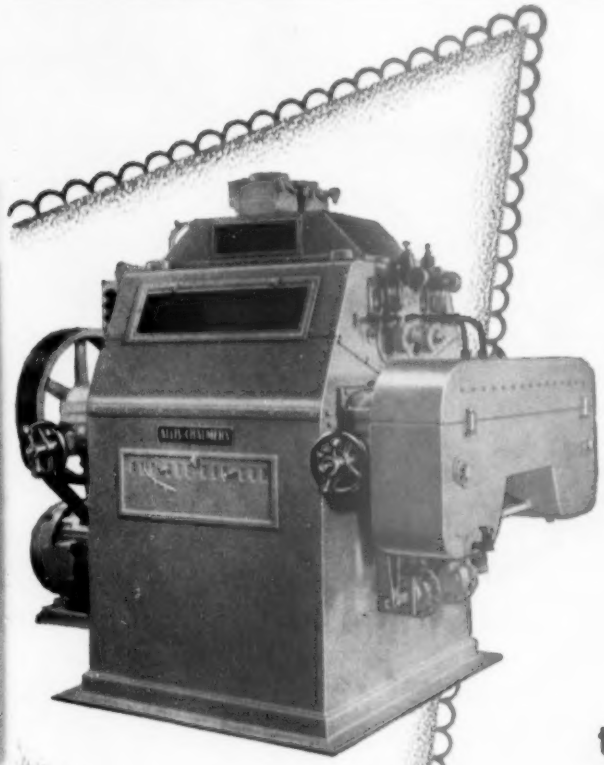
## "Balance" of the Mill

Assuming the flow of the mill is correct and that the rolls are in good condition, the first three break rolls are the key to the "balance" of the mill. If the correct amount of stock passes through the scalp of the upper breaks, it will be of the proper granulation if the rolls are not dull and will separate on the grading sieves in the correct proportion to properly load the purifiers. The purifiers, in turn, furnish the correct load of stock to the sizings and primary reductions.

Following the setting of the break rolls, the next important grinding operation is to adjust the sizings rolls which should be set by fixed extraction with the use of a test sifter and accurate balances. For sifting the sizing stock, the test sifter should be run the same period of time as used in setting the break roll.

Many millers prefer to set at least the head and middlings rolls by fixed extraction, using the automatic sifter clothed with 10XX silk.

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*By Edmund Mottershead*

DISCIPLINE is a funny proposition. Personally, like every other American, I have always resented the implications of subjection and punishment. I think the average supervisor feels the same way, as well as the typical worker. We all of us want to know, first of all, the constructive end towards which any discipline applies to ourselves is being directed.

The attitude of modern and progressive management is that the worker be handled with a view toward obtaining the best possible results with the least friction. Firm, but considerate regulation is the rule. No workman need be pampered, however; men should not expect or require coddling. The supervisor is doing them a favor if he is firm. At the same time, the supervisor must bear in mind the various aspects of labor legislation, avoid "unfair practices," and stay within the areas of acceptable activity in labor relations. Experience shows that the degree to which discipline is maintained bears a direct relationship to both the happiness of the workers and the output of the department.

**Laxity Creates Problem**

Much in discipline springs from a simple beginning. The "boss" wants to be on friendly terms with the workers and becomes overly familiar with them, losing their respect. They indulge in a little horseplay and get away with it. They start visiting during working hours. I know of one case where a manufacturing tailor employing female seamstresses at machines has only three workers who produce their quota, out of 60 workers on the floor, because of excessive visiting. Pretty soon the men start loafing a bit, sneaking a smoke during working hours, and then smoking promiscuously. They commence work late in the mornings and at the beginning of the afternoon. They begin cleaning up and closing down their maachines before quitting time in order to be ready to leave on the whistle instead of quitting on the whistle.

Then somebody starts to eat lunch during working time. There gets to be a general laxity in the matter of "good housekeeping" followed by increasing failure to observe simple safety rules, failure to use safety equipment. Somebody gets hurt, and they blame it on the supervisor for his laxity in not seeing to it that the proper safety device was used. Then there is some more horseplay and outright failure to obey orders. More dissatisfaction and irritation brings on wilful waste of materials, breakage of equipment, the slow-down. We all know the picture.

And the cause of it all was the supervisor and his inability to deal with the men properly in the first place. But you don't have to mount guard over the men, either, as this gains you nothing but dislike and opposition. Their likes and dislikes, their motives and ideals, their natural inclinations can all be turned to useful account. Discipline should not be enforced, but induced.

The problem of "reasoning" with the worker is often complicated by outside factors, the presence of other workers or supervisors, labor market conditions, and what not.

One department head related to me an experience of his: The plant superintendent visited his department the second day he had been transferred to it as supervisor. While walking through with him, the supervisor noticed that the coolant was not flowing properly through one machine. To find out if the pump was down, or if the supply of oil was too low, they both reached into the oil reservior and found that the pump was broken. Then they straightened up and supervisor said to a worker, "Hand me your towel, will you, Bud, so we can wipe our hands." The worker replied, "Who in hell are you calling 'Bud'? That isn't my name. I don't like to be called Bud. And if you want to make something of it, I'll knock your teeth down your throat."

The superintendent and the rest of the gang were taking the whole thing in. The supervisor had only been there a day and a half. The former supervisor had pointed out this man as the best operator in the place. The labor market was tight, and the new supervisor didn't know the names of his men yet. A nice pickle. So the supervisor picked up a towel himself and simply told the operator he would talk to him later on. After the superintendent left he talked with the man, who told him that for personal reasons he didn't like to be called Bud, and thought the supervisor should at least know the names of the best operators. The supervisor said that was reasonable, that the operator could possibly have gone at things a little differently, let's get acquainted, and so on. After about a week the

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two men were getting along very well.

Another supervisor relates the story of a machine tender who finally got himself fired. Jack was a machine tender in a paper mill, and a good worker, about 20 years old and single. He had been there about a year and a half. One unusually hot summer night he left his machine several times to go out in the yard for a smoke. On several of these absences the machine broke down. Each time, the supervisor went out after him, told him to come back, and stay on the job. Finally he told Jack that if he had to come out after him again he would be looking for another job. Jack left his machine about an hour later. The machine broke down. Jack got fired. Three days later the employment manager called the supervisor and asked him if there was anything against Jack, and if he would object to Jack's being hired for another department. Since men were scarce, the supervisor said he thought it would be all right, and Jack has been producing regularly and has been well behaved ever since. Maybe the jolt was all Jack needed.

### Old-Fashioned Method Useless

The old-fashioned supervisor was an autocrat who superimposed his commands on the wills of his workers. His employees' wants were ignored as unimportant. But these methods no longer bring results, and actually bring on more trouble and waste. The modern definition of discipline is "that kind of training and control which makes punishment unnecessary" . . . control by appealing to the desires of the employee.

Everett R. Conover says that the various manifestations of a lack of discipline, including tardiness, horseplay, errors, complaining, trouble making, and the rest, are traceable to definite causes. Among the causes he enumerates lack of ability, lack of understanding, willful disregard of orders, standards being too low, not enough work to do to keep busy, loss of face, poor training, lack of job pride, bad home conditions, desire to satisfy ego, lack of respect for employee, personal difficulties, belief that treatment accorded him has been unfair.

Mr. Conover has developed a three-step formula for correcting workers and maintaining discipline, which is well worth every supervisor's remembering. The three steps are—1, Counsel. 2, Caution. 3, Show Down.

**Counsel:** On the man's first "offense," take it easy. Begin if you can with praise of previous good performance or good intentions of the worker. Get him to admit his own errors before charging him with mistakes or blunders. Remember the principle of giving the worker a good name to live up to, rather than creating in his mind the feeling that he is under suspicion. Get all the facts. Find out why he acted as he did . . . what personal motives or troubles or feelings prompted the act . . . remember the operator who re-

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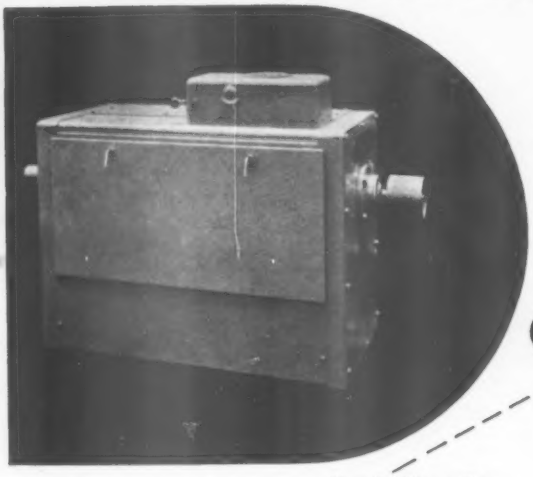

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sented being called "Bud." Attempt to work out, with the employee, ways of eliminating these causes . . . make it a joint effort to solve mutual problems. Study the individual . . . be patient with some, firm with others. Encourage the employee for effort; show him how his interests are served best by conforming to the rules and regulations. Be certain to convince the worker that you are really trying to help him and that your whole attitude is one of helpfulness rather than suspicion.

**Caution:** Even on second "offense," get the facts . . . get all the facts before making a decision. Get the worker to talk and open up on the matter. While you're at it, be sure to control your own temper. Praise any slightest improvement if you have a chance. Where possible, call attention to mistakes indirectly, so that the worker has a chance to realize his error without losing face. Sometimes it pays to talk about your own mistakes first; possibly you have not explained something to the worker, perhaps he'd like you to show him how to do it. Don't nag. Give him every opportunity to save his face. Let the employee sense that you believe in his honesty, in his good intentions, in his interest in the work, in his ability and reliability, in his willingness to settle any question fairly. Give "the dog a good name." Avoid anything which will make him feel inferior or give him the sense that you are belittling him.

**Show-Down:** The "show-down" is an old poker term. It is the end: this is it, or else. However, in maintaining good labor relations, that attitude on the part of the supervisor is not usually successful. True, there are times when the worker either will do so and so, or else; but before taking such extreme measures, investigate again and be sure you have the facts right and that the disciplinary action is really merited. Follow the practice of opening such an interview with a question about the circumstances. Avoid jumping on the employee before you have double-checked the facts with the worker. Give the person being reprimanded plenty of opportunity to talk and justify himself. You can't correct him until you know why he did the wrong thing. Give him a chance to tell you. Be a good listener. Remember, the real cause is very likely deeply hidden, and your own methods of supervision may be a contributing cause.

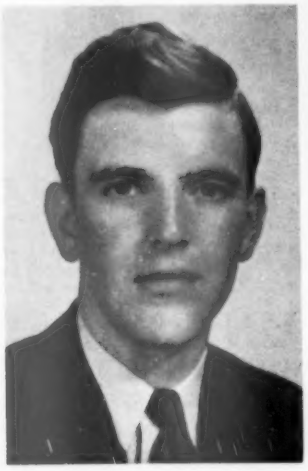
Whatever else you do, criticize the man in private. Keep in mind that the purpose of your interview and of any disciplinary action is to get better results currently and in the future, and not to hurt anyone or to relieve your own excited feelings or temper.

The need in maintaining good discipline is for thorough training and orientation of the workers, for a positive, progressive and friendly attitude among supervisors. As an aid to checking up on yourself, following you will find a check-up chart of the workers in your department, just answer "yes" or "no" whether or not you have such workers in your department.

Then look at the second part of the check-list for possible interpretations of your answers.

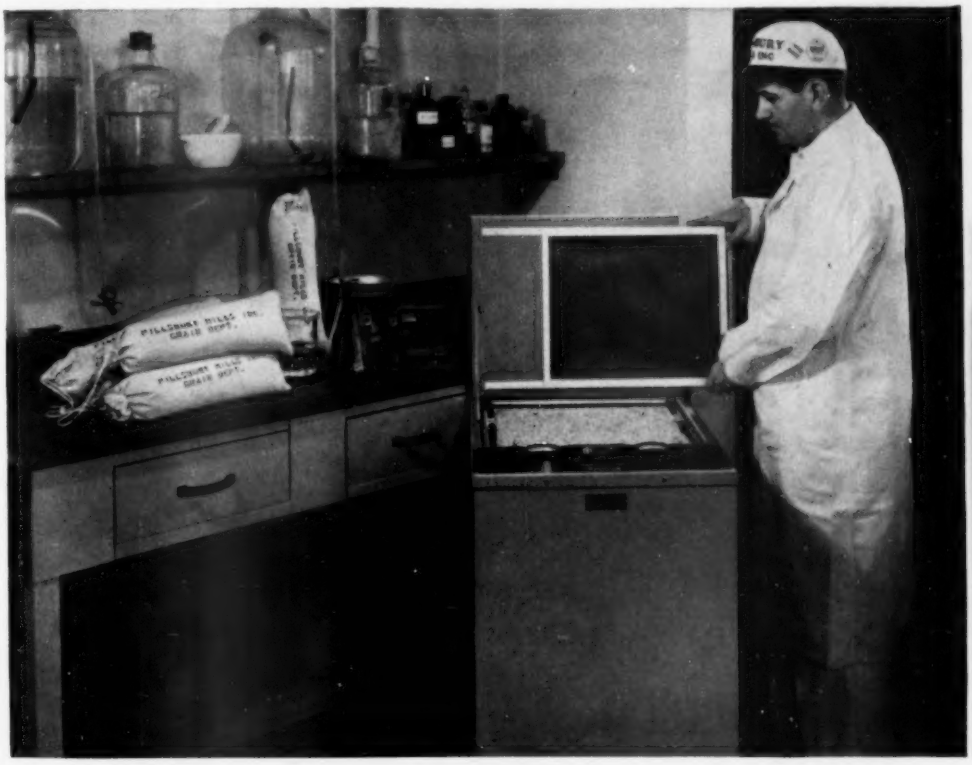
In connection with using orientation techniques to establish and maintain discipline, it is sometimes found to be sound practice to have an employee booklet with printed rules and regulations covering the various aspects of personal conduct on the job. If all employees thoroughly understand these rules, and if the rules are firmly but kindly enforced by supervisors at the lower levels, a great deal of trouble can be avoided.

Another element in maintaining



A. N. Hibbs

**HEAD MILLER—A. N. Hibbs has been named head miller of the Eagle Roller Mill Co., New Ulm, Minn., an operating division of the International Milling Co. Mr. Hibbs, a graduate of the department of milling industry, Kansas State College, Manhattan, was research engineer for the Entoleter division of the Safety Car Heating & Lighting Co., Inc., New Haven, Conn., prior to his joining the International organization about a year ago. He served as an assistant to Joseph Rezabek, milling superintendent of the Buffalo plant of the International organization for a short time before being transferred to the Eagle Roller Mill Co.**

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discipline is the possibility of employee self-government organizations. Where "industrial democracy" is really effective, there is usually so little disciplinary action required that discipline as such is not a problem. Where the workers have a sufficient stake in the success of the enterprise and also have an opportunity to make effective expression of their desires and knowledge in the conduct of the industrial enterprise, the problem becomes one of channeling their ideas and suggestions into the most effective means of action rather than straining to get their cooperation.

1. Progressive management wants leadership, not punishment; a positive attitude.

2. The three step method for disciplinary action:
   a. Counsel
   b. Caution
   c. Show-down.

**Part One:** If you recognize among the following any workers who are at present working in your department, check Yes below.

**Discipline Check Up Chart**

| | | | |
|---|---|---|---|
| 1. "Miscast" worker | ☐ | 5. Insubordinate worker | ☐ |
| 2. Chronic ailing worker | ☐ | 6. Thoughtless employee | ☐ |
| 3. Resents criticism | ☐ | 7. Conceited, "superior" worker | ☐ |
| 4. Jealous employee | ☐ | 8. Indifferent, disinterested | ☐ |
| | | 9. Temperamental employee | ☐ |
| | | 10. Worker with a "pull" | ☐ |
| | | 11. Critical worker | ☐ |
| | | 12. Chronic complainer | ☐ |
| | | 13. Lazy, clock watcher | ☐ |
| | | 14. Stubborn, uncooperative | ☐ |
| | | 15. Irresponsible worker | ☐ |
| | | 16. Shy, retiring worker | ☐ |
| | | 17. Slow, dull, stupid man | ☐ |
| | | 18. Careless worker | ☐ |
| | | 19. Irritable, nervous | ☐ |
| | | 20. Worrier, home troubles | ☐ |

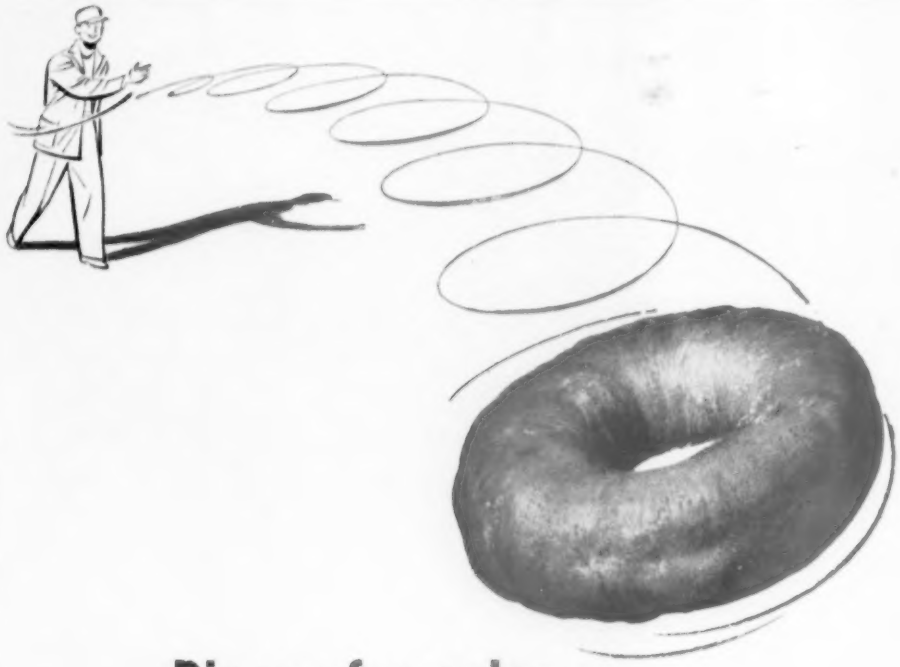
1. If you have answered Yes to numbers 1, 3, 17 or 20, there is a possibility that you need to do a little thinking about whether or not you have made a thorough enough study of the job and the man to see whether they really fit. Do you really know the worker?

2. If you have answered Yes to numbers 2, 9, 12, 18 or 19, there is a real possibility that hidden personal factors are at work in the worker of which you have no knowledge. Have you done everything to make the worker feel that his job is important? Have you done everything possible to provide good working conditions? Are you sure that these men know you really want to help them, not coerce them?

3. If you have answered Yes to numbers 4, 10, 11 or 16, there is a chance that you have not taken time to learn the real motives of your man. Have you consistently "given the dog a good name," or have you ignored human nature and tried to "drive" your men?

4. If you have answered Yes to numbers 5, 7 or 14, it is entirely possible that your entire method of supervision needs checking over. Have these men really been trained and oriented properly?

5. If you answered Yes to numbers 6, 8, 13 or 15, there is clear indication that you have fallen down on your training job, on your task of motivating your men. Think it over.

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# The Relationship Between Temperature and Humidity

## By J. E. Anderson

ATMOSPHERIC factors involved in flour milling are basically humidity and temperature. Humidity denotes the amount of water vapor which is mixed with the air in the atmosphere. The amount of moisture mixed with the air is measured both as absolute humidity and as relative humidity. Absolute humidity is a measure of the weight of water vapor which is contained in a given volume of a mixture of water vapor and air. In the English system, the amount of vapor is expressed as grains of water per cubic foot. In the metric system, absolute humidity is expressed as grams of water per cubic meter.

Relative humidity expresses the amount of moisture present in the atmosphere as a percentage of the amount which would be present at saturation. At any definite temperature a given air space can and will become saturated with water vapor if enough water is made available. When the air space is saturated, the relative humidity is considered to be 100%. But usually the vapor mixed with the air is below the saturation point, hence the amount of vapor is expressed as a part or percentage of the amount of vapor which could be present for a given temperature at saturation.

### Absolute and Relative Humidity Distinctions

The figures for absolute humidity thus give a definite measurement of the amount or weight of water vapor per unit volume regardless of temperature while relative humidity expresses different amounts of water vapor present in relation to the amounts which could be present at the given temperatures. A relative humidity of 50% at 70° F. means that the air space contains one half the water vapor which could be present at that temperature. Likewise, 50% relative humidity at 100° F. means that only one half saturation exists. While the percentages of saturation by the water vapor are the same for the two different temperatures, yet the absolute humidity in the former case would be 3.99 grains per cubic foot, while in the latter case the absolute humidity would be 9.883 grains per cubic foot. The differences in the absolute humidities are due to the greater amounts of water vapor which can be contained in a given volume at the higher temperature levels. At 70° F., air saturated with water vapor contains 7.98 grains per cubic foot while at 100° F., 19.766 grains of water vapor is contained in one cubic foot.

Relative humidity is calculated by dividing the grains of water vapor present per cubic foot by the amount which would be present at the same temperature at saturation. Thus, 3.99 ÷7.98×100=50%.

From this it follows that temperature increases affect relative humidity but not absolute humidity. If the temperature of either saturated or unsaturated vapor is increased, the relative humidity is lowered. For example, if the saturated vapor at 70° F. which contained 7.98 grains of water per cubic foot were heated to 100° F. the relative humidity would no longer be 100% because vapor at 100° must contain 19.766 grains of water per cubic foot in order to be saturated. Instead the heated vapor which still has an absolute humidity of 7.98 grains per cubic foot would have a relative humidity of 7.98÷ 19.766×100 or 40.3%. This vapor now contains only 40.3% of the water vapor which could exist in one cubic foot of space at 100° F.

Cooling of vapor increases relative humidity because it lowers the amount of vapor which can exist at saturation in a given space. Consider the half saturated vapor at 70° F. which contains 3.99 grains of water per cubic foot. When this vapor is cooled to slightly below 50° F. the relative humidity will have reached a little more than saturation or 100%, because at that temperature the air space can hold only 4.08 grains of vaporous water per cubic foot. Further cooling will cause water vapor to condense, the absolute humidity will be lowered while the relative humidity will remain at 100%.

Dew point temperature is the temperature at which water vapor becomes saturated and starts to condense to liquid water. Condensation

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in mill spouts, known as "sweating," takes place whenever the temperature is lowered below the dew point. Suppose that the relative humidity inside a given spout is 80% at 70° F. Under these conditions, 6.38 grains of water are present per cubic foot. If the temperature is lowered to 63° F. the air can hold only 6.34 grains of water. Hence any further lowering will cause condensation.

Dew point temperatures are determined by cooling the air and water vapor mixed with it until some of the water vapor condenses. The temperature at which condensation occurs (the dew point) is then observed from a thermometer so arranged to register the dew point. J. E. Anderson (1933) has described a modified form of dew point apparatus which is adapted to the determination of dew points inside mill spouts and machines. Dew point temperatures also may be indirectly determined from relative humidity determinations.

Wet and dry bulb thermometers are used in determining both relative humidities and dew point temperatures. The dry bulb thermometer simply determines the temperature of the water vapor and air. If we observe the thermometer on a hot summer day and find the thermometer reads 110° F. or make the same observation on a cold winter day and the thermometer registers —20°, we are observing the dry bulb temperatures. The wet bulb thermometer is a modified dry bulb thermometer to vary directly with the humidity and dew point as to the temperature which it registers. A cloth wick in the form of a tube is placed over the bulb of a dry bulb or ordinary thermometer and allowed to extend below the thermometer bulb. The wick is wetted prior to the determination of the wet bulb temperature. In an atmosphere of low humidity or high moisture deficiency, water will evaporate rapidly from the wetted wick. This rapid evaporation cools the bulb of the thermometer and causes it to register not the air temperature, but a temperature which is below that of the air. This is called the wet bulb temperature and the difference between the wet and dry bulb temperatures is called the "wet bulb depression." This depression is large for low humidities and small for high humidities, depending upon the amount of cooling produced by evaporation.

The sling psychrometer is an instrument commonly used for determining the wet and dry bulb temperatures. Knowing the dry bulb temperature and the wet bulb depression, the difference between wet and dry bulb thermometer readings, relative humidity, absolute humidity and the dew point temperature can be found in tables compiled for this purpose.

Moisture deficiency is the amount of unsaturation and determines the behavior of any material (in regard to its moisture content) exposed to the atmosphere. This is also related to humidity. Thus if wheat has been exposed to a very dry atmosphere and then is moved to more humid conditions, the moisture content will increase. Wheat at Omaha is said to average about 2% higher in moisture than at points in the Southwest. Likewise, if wheat is moved from east to west, loss of moisture occurs, because of the more dry air in the West.

### Evaporation and Absorption

The two phenomena, evaporation and absorption of moisture depend entirely upon the rates of the movement of water particles (vapor) in two directions, into the atmosphere and out of the atmosphere. The rates at which this exchange takes place determine whether a substance is said to dry out through the process of evaporation or absorb moisture through the process of absorption. If moisture leaves the atmosphere faster than it returns to the atmosphere, moisture is absorbed by whatever material which happens to be in contact with the atmosphere. If moisture enters the atmosphere faster than it is leaving to enter the substance with which it is in contact, the moisture content of the substance is lowered while that of the atmosphere is increased.

When evaporation takes place in the mill, the moisture content of the air is increased because the removal of water from wheat and mill stocks is at a greater rate than the rate at which water is returned to them. When water vapor is exchanged at equal rates between the atmosphere and mill stocks, no change occurs in the moisture content of the mill streams. This is known as the equilibrium moisture condition.

The changes in moisture content depend on the pressure or force exerted by water in the atmosphere and that absorbed in the substance under consideration. The magnitudes of the pressures of the atmospheric moisture and the moisture absorbed in the material such as mill stocks depend upon amounts of water present. This force exerted by water vapor is called vapor pressure or vapor tension and is due to the tendency of water molecules to escape from a surface whether from bulk water or from absorbed water. The amount of absorbed water has a marked effect on its vapor pressure. If water is in the free liquid state, the vapor pres-

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sure is 100% for the existing temperature.

Water which is absorbed in mill stocks does not exert a vapor pressure equal to that of free water unless the moisture content is far in excess of the amounts ordinarily contained in the stocks during milling.

Briefly, three relationships may exist between the moisture absorbed in the stocks and the moisture contained in the surrounding atmosphere: (1) If the vapor pressure of the atmospheric moisture is below that of the moisture absorbed in the mill stocks, evaporation will occur; (2) If the vapor pressure of the atmospheric moisture is above that of the moisture in the stocks, absorption of moisture by the stocks will occur; (3) If the vapor pressures of the atmospheric moisture and that of the stocks are equal, no change in the moisture content of the stocks or air will take place.

—BREAD IS THE STAFF OF LIFE—

## Immigration, Plus Export Trade, Aids Australian Output

An increase in immigration and enlargement of export markets has led to higher wheat flour production by the mills in Australia, compared with previous periods.

During the 1950-51 crop year, flour production by the 115 mills in that country totaled approximately 33,750,000 cwt. (1,689,000 short tons) of flour, 300,000 short tons of bran and 340,000 short tons of pollard.

The most important flour milling plants in Australia are in the state capital cities, particularly Sydney and Melbourne. A few of the plants are located in industrial or trade centers in the provinces. The principal trade association of the industry is Flour Mill Owners Council of Australia.

Flour exports for the 12-month period ended May 31, 1952 totaled approximately 15,750,000 sacks, or between 45 and 50% of the country's total production. Principal export markets for Australian flour are the United Kingdom, Ceylon and India. Considerable quantities also went to Egypt, Malaya and Indonesia. Shipments to Ceylon represented a portion of Australia's contribution to the Colombo plan.

Australians are also large consumers of wheat flour. In recent years the per capita consumption in that country has been about 192 lb., in contrast to the 131 lb. in the U.S.

The wheat growers have converted from loading their grain in bags to bulk handling, aided by the government. Formerly the wheat was sacked during harvest and was handled in that manner during all stages of its movement to market. Now, it is handled in much the same manner as in the U.S.

—BREAD IS THE STAFF OF LIFE—

## Not the Answer

Many power transmission engineers regard the various "anti-slip" belt dressings, both liquid and solid, as evidence there is something wrong with the belt or pulleys when the dressing is required. They argue that a belt drive, properly engineered and properly installed, will not need the anti-slip compounds.

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# The Story of Lubrication

ALTHOUGH the known history of lubrication can be traced only 4,595 years, the practice of lubrication is an invention of Nature itself. The muscles and joints—even the skin—of animals were supplied with fats and oils to facilitate movement and to help prolong life.

The earliest record of man's using a lubricant to help him perform a mechanical task has been found in the Egyptian tombs of Tehuti-Heteo, who lived about 1650 B.C. There the oldest known illustration of the application of a lubricant, a painting by the artist Amena-Ankhn, shows a great stone statue being moved from a quarry to a distant temple by means of a sledge, pulled by slaves over wooden planks laid along the ground. A dark green oil is being poured by a slave on to the planks ahead of the sledge.

Almost certainly lubricants had been used for a considerable period before this painting, for it has been found that the Egyptians had available nearly every animal oil and fat and approximately 13 vegetable oils. Although these were used for food products and as the base for paints, records such as the above painting reveal that the value of lubricating bearing surfaces was recognized in the early civilization.

Almost 1,400 years later, Ctesibius designed an air compressor for pipe organs whose "sliders must be rubbed with oil so that they can be easily moved and slid back into place again." This lapse of 14 centuries between the early application of lubricants to bearing surfaces and the use of lubrication in more precise machinery is evidence both of the slow development of machinery and of the correspondingly slow development of suitable lubricants.

Actually, the science of lubrication as we know it today advanced very little during the first 4500 years of

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its life, and then suddenly, within the last 90 years, it has been transformed into a highly specialized and vitally important adjunct of the mechanical engineering profession. This latter profession has virtually fostered the science of lubrication, for as new machines have been designed, as new demands have been made on both the length of life and efficiency of mechanical devices, new lubricants have been required which would enable the engineer to turn the products of his drawing board into durable and efficient expeditors of man's labor.

During the early days types of oils and lubricants available were limited, as was the scientific knowledge of their application and manufacture. The principal lubricants of that period consisted of animal and vegetable oils.

Probably the most effective lubricants for machinery were castor oil and whale oil, the former for heavy needs, and the latter for lighter machinery. Lard oil, rendered from the fat of hogs, was generally used as a belt and leather dressing and also as a cutting oil in machine shops. Linseed, cotton seed, olive, palm, cod and fish oils were also widely used, both in leather tanning, in founding, and as illuminants and in some machinery lubrication.

As late as Civil War times there still was prevalent a primitive but fairly effective means of lubricating large open bearings. Sections were cut out of pickled sides of pork with the hide and hair left on so that the tallow attached to the hide could be tucked in and held in place around the open bearing. Beef and mutton tallow also were extensively used in the lubrication of large bearings, beef tallow being accepted for over half a century as the standard lubricant of steam cylinders of the early engines and pumps.

The application of the tallow was as crude as the lubricant itself. The groaning of the pistons in the cylinders was the signal for the admission of some heated, liquid tallow oil, which was poured into the "tallow cup" while the cup valve to the cylinder was closed; the top was then put on the cup, the valve opened, and a bath of oil admitted to the piston. Almost always too much oil for the mechanism to use at one time was applied. Gradually, however, the oil would be used up until the much abused machinery would groan again and then the cycle would be repeated.

Examination of the bearings of some of these early steam engines has shown that the heat in the steam cylinders broke down the animal or vegetable oils, freeing fatty acids which etched the metal surfaces. These acids, however, as they were subjected to pressure and heat solidified and filled up the etched pores in the metal surfaces, thus conveniently compensating in some part for their own deficiencies. They also offset some of the inaccuracies in the machining of metal parts.

In cases where the boiler water contained lime or other solutions, and where priming was used, the tallow formed a paste which was rolled into hard balls the size of marbles by the action of the pistons. These balls would fall to the bottom of the cylinder and sometimes interfere with the operation of the machinery. It was quite usual for servicemen, when they checked over steam cylinders of lo-

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comotives or vertical marine engines, to take out handfuls of these "marbles." Even when certain mineral oils were prepared in later years to take the place of tallow, a similar condition occurred because of the high wax content of the mineral base lubricants.

The accepted standard of excellence for lubrication of light machinery, for illumination and for the processing of leather, however, was whale oil. During the late 17th century and the entire 18th century, whaling became one of the major industries of New England. The operation of large fleets of whaling vessels out of "Down-Eastern" ports by intrepid men of the sea gave rise to many of the best loved and heartiest stories of early American literature. The pursuit of the elusive Moby Dick in the storm-tossed reaches of the North Atlantic constituted a romantic adjunct of industrial enterprise that has fascinated generations of Americans who may have had no other interest in the early industrial history of this country.

In spite of the difficulty of obtaining it and its consequent high cost, however, the oil of the sperm whale was of such unquestioned superiority over possible substitutes, that it was probably the most generally used lubricant for the light machinery of that day.

The principal disadvantage of whale oil to early industry was its lamentable tendency to turn rancid. Although just as good a lubricant in the rancid state, this trait placed a certain limit upon the desirability of working in factories which used whale oil. It is said that one of the reasons that early textile mills did not need to put up signs to state the name and activity of the company, was that whale oil was used almost exclusively as the lubricant for the spinning machinery. In fact, it has been claimed that anyone who worked in a textile mill, especially during the summer months, became a walking advertisement for that company.

Textile mills were the first manufacturing plants to use central power, and, consequently, that industry was one of the first to operate light power machinery. Some of the difficulties experienced by early industry in connection with its lubrication problems are, therefore, typified by those of the textile mills. Whale oil vaporized, gradually covered mill windows with a brown, varnish-like matter which also clung to the bearings and spindles and other parts of the mill machinery. It was this gumming tendency, not only on the part of whale oil but on the part of most other early lubricants, which necessitated frequent cleaning and servicing of machinery.

However, as we look back upon lubricants of those days and tend to smile a little condescendingly at the comparison between today's oils and greases and those of the 18th and 19th centuries, we must remember that the design and manufacture of machinery did not demand anything better of the lubrication industry.

—BREAD IS THE STAFF OF LIFE—

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EFFECTIVE "first aid" fire fighting requires the use of a suitable extinguisher on each different class of fire. There are three classes of fire, each determined by what is burning; and for each class there are appropriate extinguishers.

Fires in ordinary combustible materials, such as wood, paper, textiles, rubbish, etc., are known at Class A fires. They are best put out with water, which has a cooling and quenching effect. Extinguishers which contain water or chemicals and water are the soda-acid, foam, pump tank, gas cartridge and loaded stream types.

Vaporizing liquid and carbon dioxide extinguishers also are effective for controlling small Class A fires, if the fires are not deep-seated and if there are no strong air currents to dissipate the vapor or gas.

Fires in flammable liquids, grease, etc., are known as Class B fires. Here a blanketing effect is essential to cut off the oxygen supply. Suitable extinguishers are foam, vaporizing liquid, carbon dioxide and loaded stream.

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C fires, require the use of extinguishants that will neither damage equipment nor convey an electrical charge along the hose stream to the operator. Vaporizing liquid and carbon dioxide extinguishers are suitable for use on fires of this class. In some cases fires in electrical equipment may be such that the quenching and cooling effect of large quantities of water is necessary. In such fires the equipment should be made electrically dead before water or water solution is applied.

The Underwriters' Laboratories label on every approved fire extinguisher indicates the class or classes of fire for which that extinguisher is considered suitable and the number of such extinguishers considered necessary to comprise one unit of protection. Thus, a 2½-gallon foam extinguisher is designated "A-1; B-1," meaning that it is approved for use on both Class A and Class B fires, and that one such extinguisher is required to make one unit of protection. These units of protection are standards that have been established by Underwriters' Laboratories for convenience in measuring the relative fire protection afforded by different kinds and sizes of portable fire extinguishing appliances.

The number of units of protection required in any given location depends upon the relative severity of the incipient fire to be anticipated. The National Fire Protection Association recognizes three general classes of occupancies—light hazard, ordinary combustible and extra hazardous. A guide for determining the number of units of protection required for each class of occupancy has been worked out. For instance, a place where fires of average intensity may be anticipated should have units so located that a person will not have to travel more than 50 feet from any point to reach the nearest unit, but at least one unit will be required for each 2,500 square feet of floor area.

The inspection department having jurisdiction usually will determine the degree of hazard of a given occupancy.

——BREAD IS THE STAFF OF LIFE——

## Nothing Sinister About Synthetic Food Improvers

In discussions of chemicals in foods, the distinction between what is natural and what is synthetic has likewise been beclouded by semantic obscurantism. The impression has prevailed that that which is natural is good, that which is man-made is evil. In an essay aptly titled "An Outline of Intellectual Rubbish," Bertrand Russell said, "Belief in 'nature' and what is 'natural' is a source of many errors. . . . Many practices which have come to seem 'natural' were originally 'unnatural'. . . . Eating cooked food is 'unnatural'. . . . Every advance in civilization has been denounced as unnatural while it was recent."

Turning to the question of the human diet, it is necessary to point out that the only food truly ordained by nature for man is human breast milk. Obviously this could not conveniently serve him throughout his life span and hence a well-intentioned Providence furnished him with a great variety of plants and animals, with the ingenuity for experimentation, and with the capacity for learning, all of which made his continued existence possible. In place of this slow and costly method of trial and error, man now has available the orderly means of experimental evaluation of potential foods using the lower orders of animal life as test subjects.

### The Question of the Natural

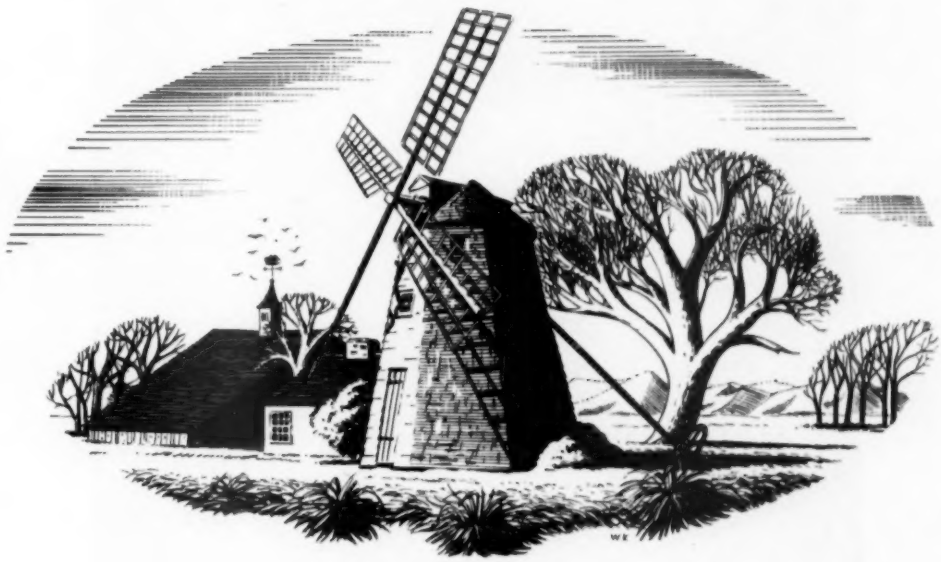
That which is natural is not necessarily wholesome. The venom of the rattlesnake is quite as natural as its meat which, though perhaps not esthetic, is quite edible. The chemical known as ascorbic acid is no more sinister after it has been isolated from orange juice than it was when nature put it there, nor should its chemical synthesis detract from its virtues in any way.

Thiamine chloride is not evil when it is made synthetically any more than certain species of toadstools are wholesome because they are products of nature. In fact raw clams which, like certain other fish, have been endowed by nature with a thiamine-destroying enzyme, are nevertheless highly regarded by man as seafood.

The late Otto Folin of Harvard University once pointed out that there was "no evidence to lead us to believe that the cinnamon, oil of cloves and other similar ingredients used by our mothers are wholesome as compared with benzoic acid." The ible aldehydes, esters and ketones. fact is that these spices and essential oils contain many chemically identified and synthetically reproduc-

Little concern is expressed for the caffeine in coffee and tea and the theobromine in cocoa; for the acetic acid in vinegar; for the oxalates in certain leafy vegetables; and for many other naturally occurring "chemicals" in foods which can be demonstrated under the usually exaggerated experimental conditions to have deleterious properties.


**How to make good food better**



*To the old-fashioned miller came many grains—wheat, corn, oats, rye—to be ground into flour. Modern milling practice loses some of the nutritional benefits present in Nature's wheat because of consumers' demand for patent flour and for white bread and rolls. How sensible it is that you restore valuable health-giving vitamins and minerals through enrichment. Your achievement in making your good foods better by this simple process of enrichment has the support of qualified authorities—physicians, nutritionists, dietitians, and of consumers themselves.*

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## Use of X-Ray

(Continued from page 1a)

festation of any given sample.

(2) The operation of the machine is simple and can be operated by a dependable non-technical employee with a minimum amount of instruction.

(3) The study and interpretation of the plate requires some training, but the technician grasps the ability of spotting hidden infestation with less training than is required in many of the control laboratory operations. The most efficient method found for training personnel for this work is to glue a sample to a thin sheet of paper and x-ray the sample. In this manner the trainee will have the plate to study and also the original sample intact. When a questionable kernel is found on the x-ray plate he may refer back to his actual sample for confirmation of his x-ray findings.

(4) The operation offers a fairly rapid means of inspection of car samples for hidden insects. A sample may be inspected for gross infestation within approximately 20 minutes, or completely studied in approximately two hours.

(5) The x-ray gives a good check in hidden infestation which is otherwise difficult to detect.

(6) It is believed the x-ray technique will measure up to the accuracy of any method for checking hidden infestation now employed by the industry.

As viewed by this operator, the disadvantages of this operation are:

(1) The initial cost of the machine at present limits its use to terminal elevators and milling concerns. It has been shown that infestation begins in the local elevators and on the farm and some very economical test is needed for use at these levels.

Much of the work on the machine is in the experimental stage but rapid progress is being made towards standardization of the technique. A collaborative group has been organized by the first six firms using the machine for control and research. The goal set for this group is to attain a standard procedure for operation and a uniform method of interpretation of the plates. Preliminary work on this study has been very gratifying in that these operators agree very well on the interpretation of the results.

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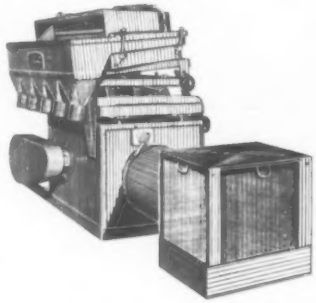

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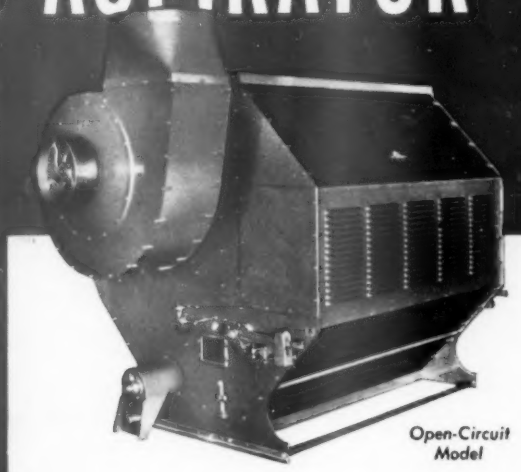
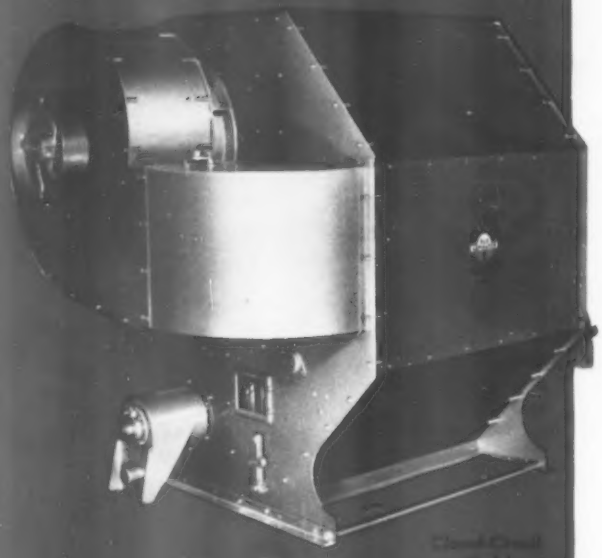
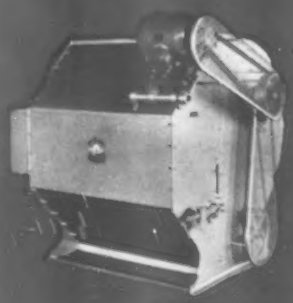


Open-Circuit Model



With Motor Drive



The closed-circuit Duo-Aspirator provides two separations: the grain or heavier material is aspirated, and the lighter material removed. The open-circuit model provides three-way separation: the grain or other material is aspirated, the heavier material removed by aspiration is discharged from the settling chamber, and dust and other light material are exhausted from the fan to a collector.

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